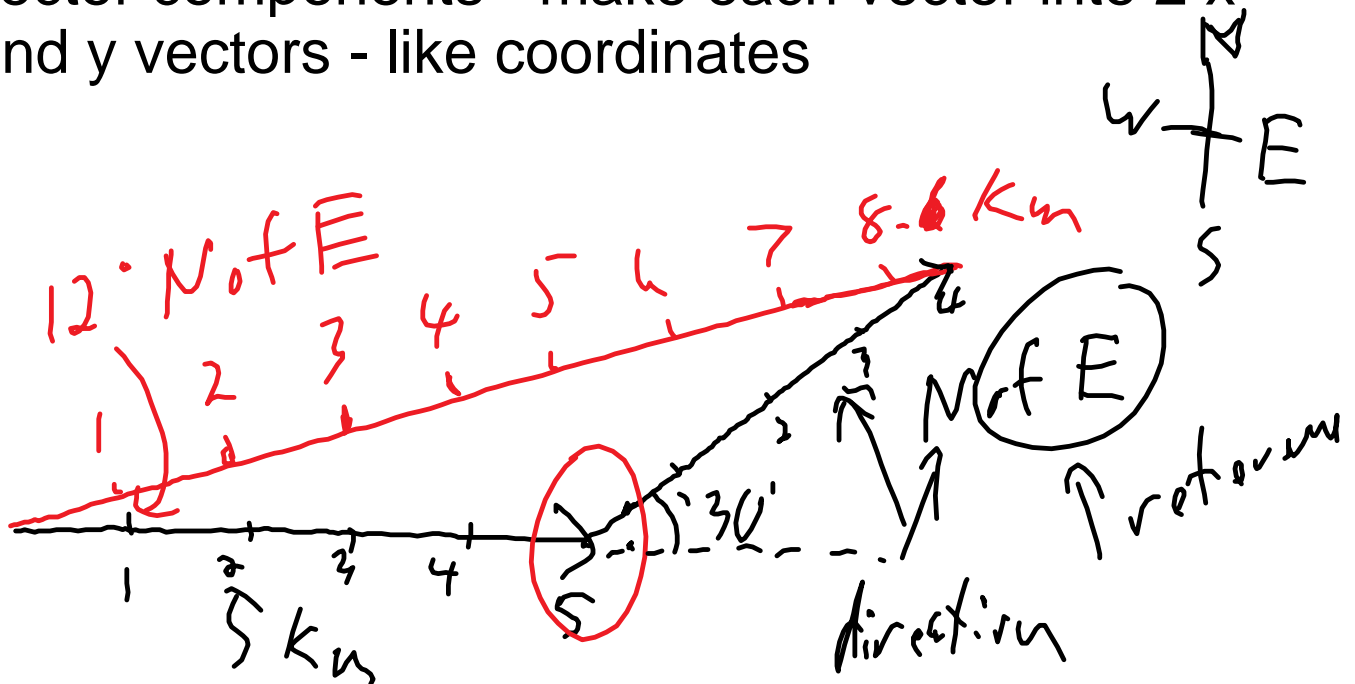


Vectors Review:

eg. you walk 5.00 km East, then 4.00 km 30.0° North of East. What is the resulting displacement? (magnitude and direction)

3 methods:

1. scale diagram with ruler and protractor
2. sine and cosine law
3. vector components - make each vector into 2 x and y vectors - like coordinates

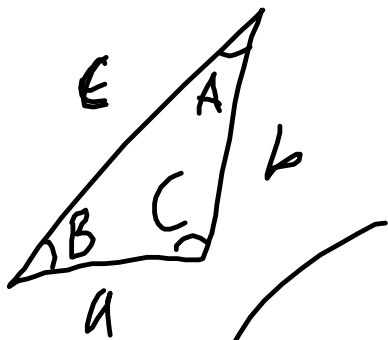


Add vectors - draw
Head to tail
resultant vector - tail

of first Vector to head
of last Vector.

From the scale diagram, the resultant
displacement is 8.6km 12° N of E.

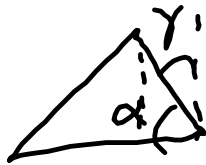
2. Cosine/Sine Laws



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

→ ambiguous case

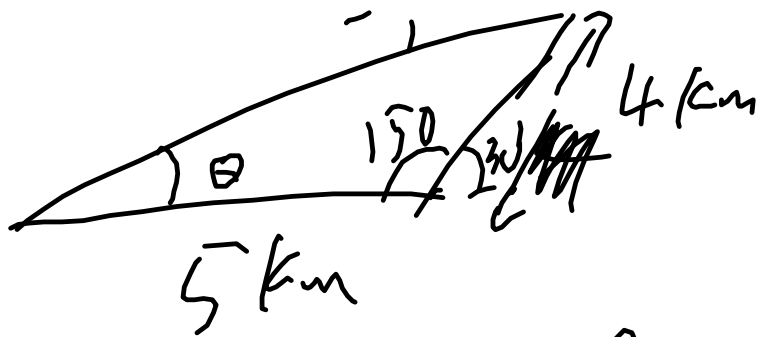


if $90 - \alpha = \gamma$

$\beta - 90 = \gamma$

then $\sin \alpha = \sin \beta$





$$V_r^2 = 3^2 + 4^2 - 2(5 \times 4) \cos 150$$

$$V_r = 8.7 \text{ km}$$

$$\frac{\sin \theta}{4} = \frac{\sin 150}{8.6972}$$

$$\theta = 13.1^\circ$$

$$8.7 \text{ km } 13^\circ \text{ N. of E}$$

3. Components

V_E - 5 km East

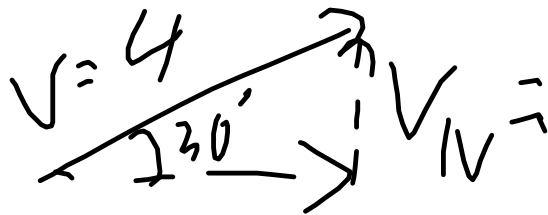
V_N 0 km North

call call call

V_E 5 km East

V_N 0 km North

SOHCAHTOA



$$\sin \theta = \frac{V_N}{V}$$

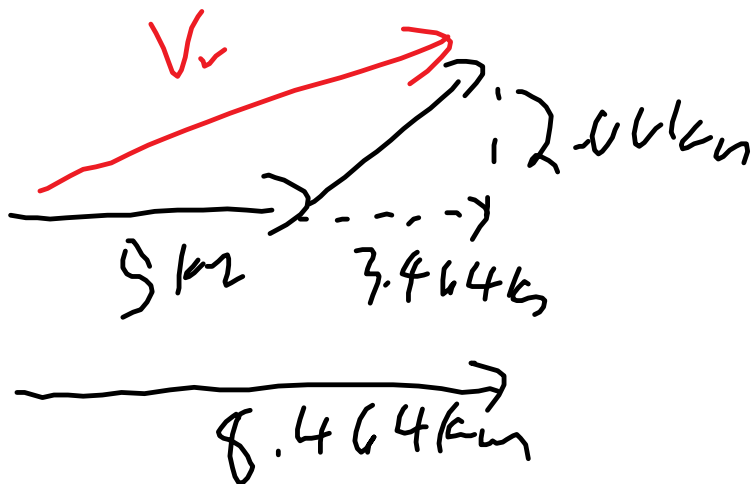
$$V_E = V \cos \theta$$

$$V_N = V \sin \theta$$

$$4 \cos 30 =$$

$$3.464$$

$$V_N = 4 \sin 30 \\ = 2.00 \text{ km}$$



$$V_r^2 = 2^2 + 8.464^2$$

$$V_r =$$

$$= \text{Sqrt}(4 + (8.464 \times 8.464)) =$$

$$8.697085488829001$$

8.7 km coincidence?

$$\theta = \text{Atan}(2/8.464) = 13.29484013652083$$

$$13^\circ$$

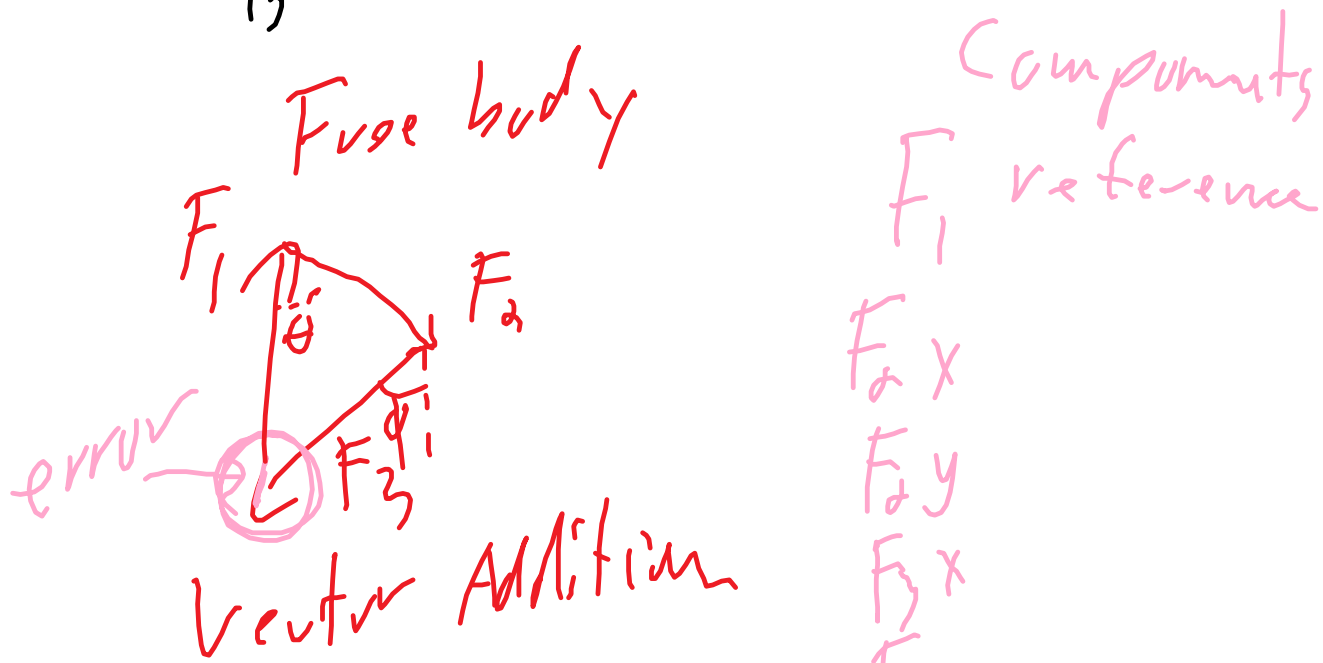
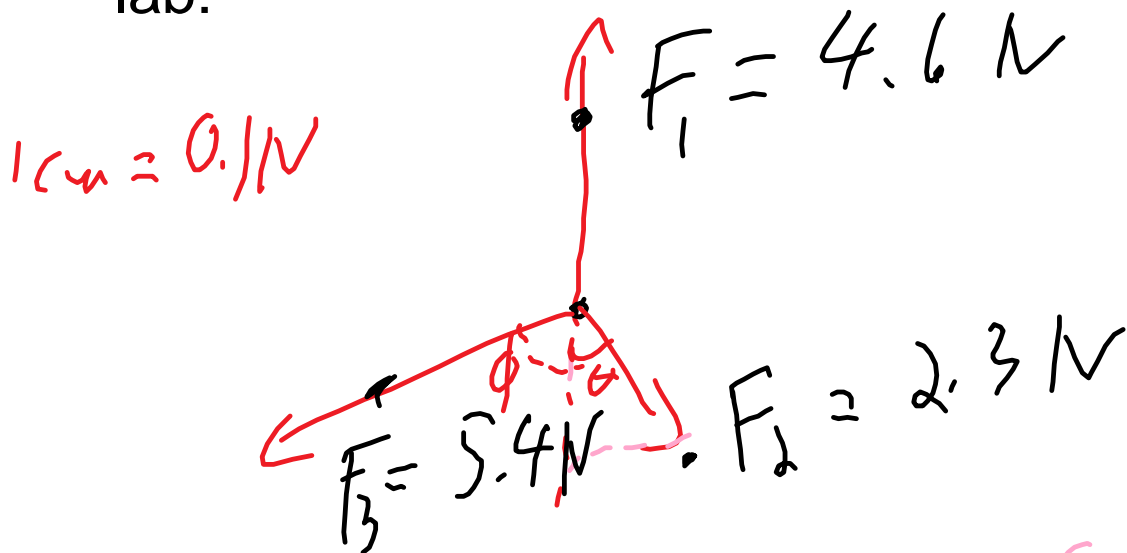
displacement was 8.7 km 13° N of E
again.

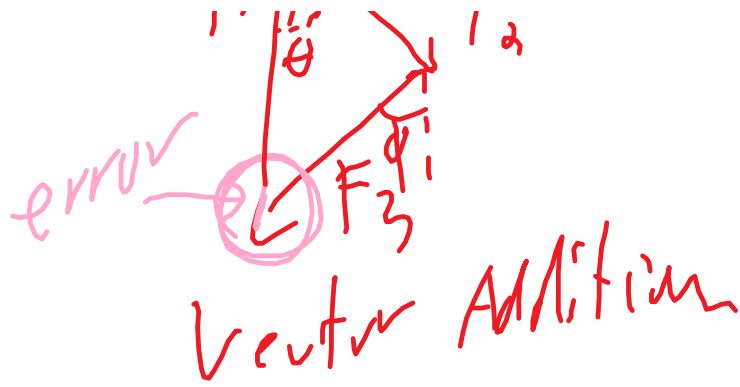
<https://www.youtube.com/watch?v=LyEq5OuAS4>

eg. A boat is moving at 5.0 m/s in a fast flowing river flowing at 3.0 m/s. What is the resultant speed and time to cross the 50.0m wide river if

- the boat points directly across
- the boat points upstream so the resultant velocity is directly across
- the boat points 42.1° off the shore pointing downstream.

lab:





$F_2 x$
 $F_2 y$
 $F_3 x$
 $F_3 y$